CLAIMS

What is claimed is:

1. A resistive film for use in a potentiometer, the film being contacted by a movable wiper, the film comprising:

a) a cured polymer resin;

b) a plurality of conductive particles selected from the group consisting of carbon black, graphite and mixtures thereof, the conductive particles causing the resins to be electrically conductive; and

c) a plurality of nanoparticles, the nanoparticles increasing wear resistance and reducing electrical noise of the resistive film.

2. The resistive film of claim 1 wherein the cured polymer resin makes up 40-75 percent by weight of the resistive film.

3. The resistive film of claim 1 further comprising a cured thermosetting resin.

4. The resistive film of claim 3 wherein the cured thermosetting resin makes up 1-5 percent by weight of the resistive film.

5. The resistive film of claim 1 wherein the conductive particles make up 10-35 percent by weight of the resistive film.

6. The resistive film of claim 1 wherein the nanoparticles make up .025–20 percent by weight of the resistive film.

7. The resistive film of claim 1 wherein the nanoparticles are chosen from the group consisting of carbon nanotubes, carbon nanofibers, vapor grown carbon fibers, milled carbon fibers, nanoclay, molecular silica and mixtures thereof.

8. The resistive film of claim 6 wherein the nanoparticles are 1-5 percent by weight of the total composition.

9. The resistive film of claim 1 wherein the cured polymer resin is chosen from the group consisting of polyimides, polyamide imides, polysulfones, polyphenylenes, polyether sulfones, polyarylene ethers, polyphenylene sulfides, polyarylene ether ketones, phenoxy resins, polyether imides, polyquinoxalines, polyquinolines, polybenzimidazoles, polybenzoxazoles, polybenzothiazoles, phenolic, epoxy and diallyll isophthalate.

10. The resistive film of claim 4 wherein the thermosetting resin is chosen from the group consisting of aromatic cyanate ester, epoxy, phenolic, diallyl isophthalate and bismaleimide.

11. The resistive film according to claim 1, wherein the resistive film is disposed on a substrate, the substrate chosen from the group consisting of polyimide, ceramic, FR-4 and fiber reinforced phenolic.

12. The resistive film according to claim 7, wherein the carbon nanotubes have a particle size less than 100 nanometers in one dimension.

13. The resistive film according to claim 7, wherein the vapor grown carbon nanofibers have a particle size range of 50 nanometers to 10 microns in one dimension.

14. The resistive film according to claim 7, wherein the milled carbon fibers have a particle size range of 100 nanometers to 10 micron in one dimension.

15. A potentiometer comprising:

a) a planar substrate having a surface;

b) a film disposed on the surface of the substrate, the film including:

b1) a polymer resin;

b2) a thermosetting resin;

b3) 10-35 percent by weight of conductive particles selected from the group consisting of carbon black, graphite and mixtures thereof;

b4) .025 -20 wt. percent by weight of carbon nanoparticles selected from the group consisting of vapor grown carbon fibers, carbon nanotubes, milled carbon fibers and mixtures thereof; and

c) a movable wiper in contact with the film, the wiper movable across the film, the carbon nanoparticles reducing wear between the wiper and the film as the wiper moves across the film.

16. The potentiometer according to claim 15 wherein the resistive film has a uniform surface that results in a linear electrical output when a voltage is applied between the wiper and the resistive film.

17. The potentiometer according to claim 15, wherein the substrate is chosen from the group consisting of polyimide, ceramic, FR-4 and fiber reinforced phenolic.

18. The potentiometer according to claim 15, wherein the carbon nanotubes have a particle size less than 100 nanometers in one dimension.

19. The potentiometer according to claim 15, wherein the vapor grown carbon nanofibers have a particle size range of 50 nanometers to 10 micron in one dimension.

20. The potentiometer according to claim 15, wherein the milled carbon fibers have a particle size range of 100 nanometers to 10 microns in one dimension.

21. The potentiometer according to claim 15, wherein the film further comprises: nanoclay, molecular silica, polytetrafluroethylene and mixtures thereof.

22. The potentiometer according to claim 1, wherein the film further comprises: nanoclay, molecular silica, polytetrafluroethylene and mixtures thereof.